

# **ABSTRACT**

An asymmetric twin waveguide (ATG) structure is disclosed that significantly reduces the negative effects of inter-modal interference in symmetric twin-waveguide structures and which can be effectively used to implement a variety of optical devices. The ATG structure of the invention can be monolithically fabricated on a single epitaxial structure without the necessity of epitaxial re-growth. To achieve the ATG structure of the invention, the effective index of the passive waveguide in the ATG is varied from that of a symmetric twin waveguide such that one mode of the even and odd modes of propagation is primarily confined to the passive waveguide and the other to the active waveguide. The different effective indices of the two coupled waveguides result in the even and odd modes becoming highly asymmetric. As a result, the mode with the larger confinement factor in the active waveguide experiences higher gain and becomes dominant. In a further embodiment, the active waveguide is tapered to reduce coupling losses of the optical energy between the passive waveguide and the active waveguide. In a further embodiment, a grating region is incorporated atop the passive waveguide to select certain frequencies for transmission of light through the passive waveguide.

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